PATENT ABSTRACTS OF JAPAN

(11)Publication number : **11-307266**

(43)Date of publication of application : **05.11.1999**

(51)Int.Cl. H05B 33/22
H05B 33/14

(21)Application number : **10-113149**

(22)Date of filing : **23.04.1998**

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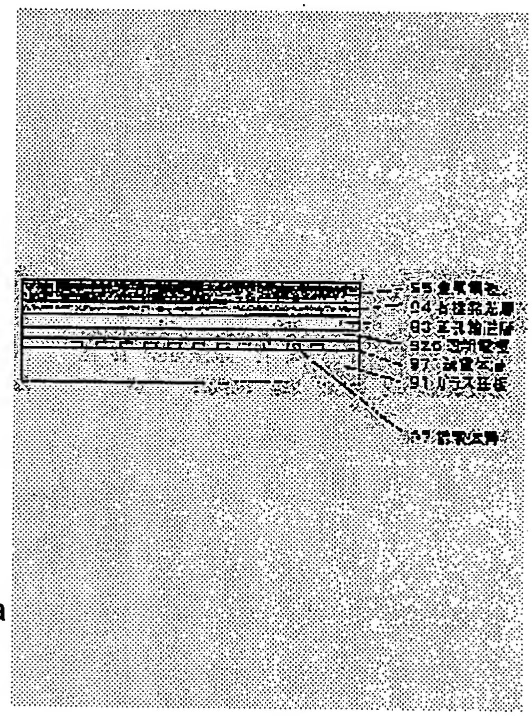
(54) ORGANIC LUMINESCENT ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an organic luminescent element excellent in monochromaticity.

SOLUTION: A hole and an electron are injected into an organic luminescent layer 94 from a transparent electrode 926 and a metal electrode 95 respectively in order to produce luminescence. Emitted light is confined in a photoconductive wave path formed by the transparent electrode 926 of a high refractive index sandwiched by an organic luminescent layer 94 of a low refractive index and a glass board 91, and is transmitted as conductive light wave in a direction in parallel with the glass board 91. A periodical distribution of the refractive index is formed in the photoconductive wave path by a dielectric formed periodically, and since diffracted light to light having a specific wave length corresponding to the period of the conductive wave light is transmitted in a reverse direction, an oscillator is formed, and only light determined by this oscillator is intensively emitted.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the organic light emitting device using an organic semiconductor.
[0002]
[Description of the Prior Art] Development of a low power and a high-definition plate mold display device is activating with development of high-advancement-in-information-technology multimedia society. The liquid crystal display component of a nonluminescent mold is characterized by the low power, the location is established, and the application to a Personal Digital Assistant etc. and the further high performance-ization are progressing. On the other hand, an organic electroluminescence display is a spontaneous light type, and researches and developments are activating very from it being easy to recognize in the interior of a room where a display is most generally used for the purpose of implementation of substitution of the conventional CRT, the big screen display with implementation difficult in CRT, or a super-high definition display. The alphanumeric display of monochrome (green, yellow) has reached the skill level near practical use, and the expectation for the high brightness which harnessed the description of organic electroluminescence, and the highly minute color display which can also display development of a thin display and a dynamic image is already growing from now on.
[0003] Since it proved that the organic electroluminescence which emits light by the low battery by ****** became possible when tongues will carry out adhesion formation of the electrode layer for hole injections, an organic electron hole transporting bed, an organic electronic transportability luminous layer, and the electronic notes necessary electrode layer on a glass substrate in 1987 (reference: C.W.Tang et al.Appl.Phys.Lett.Vol.51 and p.913 (1987)), the organic EL device is capturing the spotlight greatly.
[0004] The outline of the conventional organic EL device proposed with tongues is explained using drawing 11 . The anode plate 112 where it has the comparatively big ionization potential of indium oxide tin (ITO) etc., and impregnation of an electron hole becomes with an easy transparent conductive thin film (ITO) is formed on the glass substrate 111. next, the front face -- the electron hole transporting bed 113 and the luminous layer 114 of electronic transportability are mostly formed in the whole surface in order. And the cathode 115 which has comparatively low work functions, such as a silver Magnesium alloy (AgMg), and becomes in the easy metal layer of impregnation of an electron is formed in the front face.
[0005] Although the luminous layer 114 of electronic transportability generally has a low work function as compared with a metal, impregnation and its transport of an electron can realize it comparatively easily by using as cathode the metal which has low work functions, such as an AgMg alloy. Moreover, since the electron hole transporting bed 113 has comparatively big ionization potential, impregnation and its transport of an electron hole can be realized comparatively easily by using the big ingredient of the ionization potential of gold (Au), indium oxide tin (ITO), etc. as an anode plate. Then, by impressing forward direct current voltage to an anode plate to cathode, an electron hole is poured into the electron hole transporting bed 113 from an anode plate (ITO) 112, and an electron is poured into the luminous layer 114 of electronic transportability from cathode 115, when these join together further in the luminous layer near the joint of the electron hole transporting bed 113 and the luminous layer 114 of electronic transportability, an exciton is formed and the green luminescence 116 arises. As for this luminescence, observation is made through a transparent electrode and a substrate. Of course, the organic luminous layer of electron hole transportability and the organic layer of electronic transportability are joined, and luminescence is obtained also by pouring in and conveying an electron hole and an electron.
[0006] This luminescence principle is similar to the inorganic light emitting diode formed by gallium arsenide etc., and it can be made to correspond with luminescence by an electron and an electron hole recombining near the joint by pouring an electron and an electron hole into the compound semiconductor with which the PN junction was carried out. and an electronic transporting bed makes an N type compound semiconductor and an electron hole transporting bed

contrast with a P type compound semiconductor -- it can carry out.
[0007] Then, while the organic-semiconductor ingredient and additive ingredient which emit light in blue or red are developed, some methods for realizing a color display are also proposed, and a color display has also come to be made as an experiment. The following five methods are proposed as a method which realizes a color display by organic electroluminescence.
[0008] (1) How to arrange superficially by turns red, green, and three kinds of organic luminescent material that produces blue luminescence.
[0009] (2) How to carry out the laminating of red, green, and three kinds of organic luminescent material that produces blue luminescence.
(3) The organic material which carries out white (wide band is green) luminescence, and the approach of forming three kinds of resonator structures.
[0010] (4) How to combine the organic material which carries out white luminescence, and a light filter in three primary colors.
[0011] (5) How to combine the color conversion layer changed into the organic material which carries out blue luminescence, and three primary colors.
[0012] However, the big technical problem is left behind to each method. Since a problem is in the water resisting property of an organic material, and chemical resistance by the 1st method, it is difficult to carry out micro processing of the organic thin film formed once, and it dramatically difficult to realize a high definition display.
[0013] It is very difficult to form an efficient color display by this method next to impossible [since the 2nd method of the thermal resistance of an organic material is insufficient, it is difficult to carry out the laminating of the ITO layer with high permeability, and to form it, and / forming a laminating constituent child with high permeability, since it is necessary to use the low metal of a work function as cathode when it is organic electroluminescence further] therefore.

[0014] In order to be greatly dependent on the thickness of a thin film for the luminescent color to form a resonator by the 3rd method, it is dramatically difficult to realize a uniform color display over a large area.
[0015] Although the 4th and 5th approaches are comparatively excellent when realizing high definition, by the 4th method, they are impossible for realizing an efficient display in order to use a light filter, and cannot but wait for development of a white luminescent material reliable further now. Again. the 5th method -- the conversion efficiency of the light from blue to red -- low -- a well head and high -- it is difficult to realize a brightness display.
[0016]
[Problem(s) to be Solved by the Invention] As explained above, it was difficult to realize a practical high definition color display in the conventional organic light emitting device.
[0017] This invention offers the color display of a new method while offering the method which controls the luminescence wavelength based on a new principle. Especially, a fault is conquered for the colorization method of the conventional organic light emitting device, and the color display of high definition and high-reliability is realized.
[0018]
[Means for Solving the Problem] In order to solve this technical problem, at least the organic light emitting device of this invention on a substrate An anode plate, In the organic light emitting device which luminescence produces in a luminous layer by forming the organic thin film layer and cathode containing a luminous layer, and injecting an electron hole and an electron into an organic thin film layer from an anode plate and cathode, respectively A layer with a refractive index higher than a luminous layer is optically combined with said luminous layer including the field close to said luminous layer. And the optical waveguide layer which makes the light which emits light by said luminous layer spread in the parallel direction to a substrate front face is formed, and the field where the effctive index is changing to a part or the whole of this optical waveguide layer periodically in the parallel fixed direction to a substrate front face is formed.
[0019] Moreover, the organic thin film layer and cathode where the organic light emitting device of this invention contains an anode plate and a luminous layer at least on a substrate are formed. In the organic light emitting device which luminescence produces in a luminous layer by pouring an electron hole and an electron into an organic semiconductor from an anode plate and cathode, respectively By at least one side being transparent, approaching said luminous layer, and forming a layer with a refractive index higher than a luminous layer among an anode plate or cathode The optical waveguide layer which spreads the light which emits light by said luminous layer in the parallel direction to a substrate front face is formed. The field where the effctive index is changing to a part or the whole of said optical waveguide periodically in the parallel fixed direction to a substrate front face is formed. the inside of the light which has the structure said whose propagation light and hard flow propagation light and feedback light resonate mutually and suit by carrying out diffraction feedback of the light, and resonated -- the scattered light -- or -- low -- degree the diffracted light penetrates a transparent electrode and is emitted to the exterior of a component.

[0020] The color display of the high definition which emits light in the luminescence wavelength of the monochromatic outstanding request by these configurations, and high-reliability is realizable.
[0021]
[Embodiment of the Invention] The organic thin film layer and cathode where invention of this invention according to claim 1 contains an anode plate and a luminous layer at least on a substrate are formed. In the organic light emitting device which luminescence produces in a luminous layer by injecting an electron hole and an electron into an organic thin film layer from an anode plate and cathode, respectively A layer with a refractive index higher than a luminous layer is optically combined with said luminous layer including the field close to a luminous layer. And the optical waveguide which makes the light which emits light by the luminous layer spread in the parallel direction to a substrate front face is formed. By the organic light emitting device characterized by forming the field where the effctive index is changing to a part or the whole of this optical waveguide periodically in the parallel fixed direction to a substrate front face, the light of specific wavelength according to periodic change of an effctive index emits light strongly, and high luminescence of color purity is obtained.
[0022] The organic thin film layer and cathode where invention according to claim 2 contains an anode plate and a luminous layer at least on a substrate are formed. In the organic light emitting device which luminescence produces in a luminous layer by pouring an electron hole and an electron into an organic semiconductor from an anode plate and cathode, respectively By at least one side being transparent, approaching a luminous layer, and forming a layer with a refractive index higher than a luminous layer among an anode plate or cathode The optical waveguide which spreads the light which emits light by the luminous layer in the parallel direction to a substrate front face is formed. The field where the effctive index is changing to a part or the whole of optical waveguide periodically in the parallel fixed direction to a substrate front face is formed. the inside of the light which has the structure propagation light and whose hard flow propagation light and feedback light resonate mutually and suit by carrying out diffraction feedback of the light, and resonated -- the scattered light -- or -- low -- by the organic light emitting device characterized by for degree the diffracted light penetrating a transparent electrode and emitting it to the exterior of a component The light of specific wavelength according to periodic change of an effctive index emits light strongly, and high luminescence of color purity is obtained.
[0023] While invention according to claim 3 has the structure where the organic thin film layer and cathode which contain an anode plate and a luminous layer at least were formed on the substrate and at least its one side is transparent among an anode plate or cathode Optical waveguide is formed of said luminous layer and a layer with the high refractive index installed by approaching. By the organic light emitting device characterized by forming two or more sorts of fluctuation periods of the effctive index which the field where the effctive index is changing periodically is formed in optical waveguide, and was formed in optical waveguide Two or more sorts of light of specific wavelength according to periodic change of an effctive index emits light strongly, and two or more sorts of luminescence with high color purity is obtained.
[0024] Invention according to claim 4 makes the optical length of the period of effctive-index change formed in claims 1-3 in the organic light emitting device of a publication at optical waveguide the integral multiple of the one half of luminescence wavelength.
[0025] Invention according to claim 5 makes the optical length of the period of effctive-index change formed in optical waveguide the one half of luminescence wavelength in an organic light emitting device according to claim 4.
[0026] Invention according to claim 6 makes equal to luminescence wavelength the optical length of the period of effctive-index change formed in optical waveguide in an organic light emitting device according to claim 4. According to these configurations, the secondary diffracted light resonates and the primary diffracted light is emitted from a light emitting device.
[0027] In the organic light emitting device of a publication, invention according to claim 7 approaches a luminous layer, forms in either of claims 1-3 the field where the effctive index in optical waveguide changes, and makes a plane light which penetrates a transparent electrode and is emitted to the exterior of a component.
[0028] Invention according to claim 8 by forming on a substrate the organic thin film layer and cathode which contain an anode plate and a luminous layer at least, and injecting an electron hole and an electron into an organic thin film layer from an anode plate and cathode, respectively The transparent layer which has the field where a refractive index is higher than the luminous layer installed near the luminous layer, and the refractive index is changing periodically in the organic light emitting device which luminescence produces in a luminous layer is formed. Spread the light which emits light by said luminous layer, and the effctive index by the organic light emitting device characterized by forming the optical waveguide layer which has the field which is changing periodically in the fixed direction of a substrate front face Two or more sorts of light of specific wavelength according to periodic change of an effctive index emits light strongly, and two or more sorts of luminescence with high color purity is obtained.
[0029] In an organic light emitting device according to claim 8, optical waveguide is formed including a transparent

electrode with a refractive index higher than a luminous layer, and the presentation of a transparent electrode changes invention according to claim 9 in the fixed direction periodically.
[0030] In an organic light emitting device according to claim 8, optical waveguide is formed including a transparent electrode with a refractive index higher than a luminous layer, and the thickness of a transparent electrode changes invention according to claim 10 in the fixed direction periodically.
[0031] Invention according to claim 11 by forming on a substrate the organic thin film layer and cathode which contain an anode plate and a luminous layer at least, and injecting an electron hole and an electron into an organic thin film layer from an anode plate and cathode, respectively The transparent layer which has the field where a transparent layer and a transparent refractive index with a refractive index higher than the luminous layer installed near the luminous layer are changing periodically in the organic light emitting device which luminescence produces in a luminous layer is formed. Spread the light which emits light by the luminous layer, and the effctive index by the organic light emitting device characterized by forming the optical waveguide layer which has the field which is changing periodically in the fixed direction of a substrate front face Two or more sorts of light of specific wavelength according to periodic change of an effctive index emits light strongly, and two or more sorts of luminescence with high color purity is obtained.
[0032] Either an anode plate or the cathode of invention according to claim 12 are transparent at least. A luminous layer is approached. To a transparent electrode side A transparent layer with a refractive index higher than a luminous layer, The transparent layer which has the field where the refractive index is changing to the list periodically near a luminous layer or the high refractive-index layer is formed. Spread the light which emits light by the luminous layer, and the effctive index by the organic light emitting device characterized by forming the optical waveguide layer which has the field which is changing periodically in the fixed direction of a substrate front face Two or more sorts of light of specific wavelength according to periodic change of an effctive index emits light strongly, and two or more sorts of luminescence with high color purity is obtained.
[0033] Invention according to claim 13 is set to an organic light emitting device according to claim 12. A transparent electrode becomes in a layer with a refractive index higher than a luminous layer, and the transparent layer which has the field where the refractive index is changing periodically near a luminous layer or the transparent electrode layer is formed. The light which emits light by the luminous layer is spread, and the optical waveguide layer which has the field which is changing periodically is formed in the direction where the effctive index of a substrate front face is fixed.

[0034] The transparent layer in which invention according to claim 14 has the field where the refractive index is changing periodically in an organic light emitting device according to claim 11 is formed including an organic thin film layer, and is changing periodically [the presentation of an organic thin film] in the fixed direction.
[0035] The transparent layer in which invention according to claim 15 has the field where the refractive index is changing periodically in an organic light emitting device according to claim 11 is formed including a dielectric layer, and is changing periodically [the presentation of a dielectric layer] in the fixed direction.
[0036] The transparent layer in which invention according to claim 16 has the field where the refractive index is changing periodically in an organic light emitting device according to claim 11 is formed including a dielectric layer, and is changing periodically [dielectric layer thickness] in the fixed direction.
[0037] Invention according to claim 17 is formed including the dielectric layer of plurality [layer / which has the field where the refractive index is changing periodically in an organic light emitting device according to claim 11 / transparent], and the much more dielectric layer thickness or the much more presentation is changing in the fixed direction periodically at least.
[0038] In an organic light emitting device according to claim 3, invention according to claim 18 is what the fluctuation period of the effctive index formed in optical waveguide made red, green, and two or more sorts of periods corresponding to a blue light, and enables a color picture display.
[0039] (Gestalt 1 of operation) The outline principle of the organic light emitting device of this invention is explained, referring to drawing 1 . Drawing 1 (A) is the layer sectional view of a light emitting device, and shows the refractive index and the optical intensity distribution of each class in this component to drawing 1 (B).
[0040] In drawing 1 (A), 1 is a glass substrate. In the front face, sequential formation of the organic luminous layer 4 by the organic-semiconductor thin film with which the refractive index contains the transparent periodic high refractive-index layer 6 which is changing periodically, and which is a semi-conductor layer, and a luminous layer more highly than the organic-semiconductor layer in which a transparent electrode 2 and a refractive index contain a luminous layer, and the metal electrode 5 is carried out. Luminescence arises by pouring a carrier into the luminous layer in the organic luminous layer 4 from a transparent electrode 2 and a metal electrode 5. However, since the periodic high refractive-index layer 6 is formed near the organic luminous layer 4 as shown in drawing 1 (B), the generated light is confined in the inside of the periodic high refractive-index layer 6 pinched by the layer 4, i.e., the organic luminous layer, and glass substrate 1 of the ends where a refractive index is low, or its near, and the generated

light is spread in the direction parallel to a glass substrate 1 as a waveguide light 7. However, since the refractive-index distribution which has a fixed period by the periodic high refractive-index layer 6 is formed in this optical waveguide, only the light 8 of specific wavelength according to this period is reflected in hard flow by diffraction phenomena among the waveguide light 7 which spreads the inside of waveguide. Then, since the propagation light of the same wavelength as this wavelength of a wave reflected will interfere mutually, will suit and will suit in slight strength, a resonator is formed in parallel with a glass substrate 1 to specific wavelength. Consequently, only the light of the specific wavelength determined with this resonator among the light produced in the organic luminous layer 4 emits light strongly. And the light shut up in the resonator of a waveguide mold is emitted outside from a substrate through a glass substrate 1 by dispersion in waveguide.

[0041] At this time, if the optical length of the fluctuation period of the effctive index of the waveguide accompanying periodic structure is the integral multiple of the one half of luminescence wavelength, the diffracted light of a low degree will be taken out. For example, in being almost the same as that of luminescence wavelength, the secondary diffracted light resonates, and the primary diffracted light 9 is then emitted to a substrate and a perpendicular direction.

[0042] In the light emitting device of this configuration, the spectrum of the light which emits light is near the resonant wavelength, and high luminescence of color purity is obtained extremely. Therefore, luminescence of a color with high color purity can be obtained by making the fluctuation period of an effctive index correspond to red, green, blue, etc., respectively.

[0043] Moreover, since only a wave with the oscillating direction of the light spread in the waveguide which generally has the periodic structure of a refractive index parallel to periodic structure receives diffraction, as for the light emitted outside from the waveguide of this periodic structure, it is possible that the light which has a polarization component in the same direction as periodic structure controls the polarization direction of luminescence by controlling the direction which is most and forms this periodic structure.

[0044] In addition, in this example, although the waveguide of the optical feedback nature to specific wavelength is formed by forming the organic luminous layer 4 and the periodic high refractive-index layer 6 which has periodic refractive-index distribution between transparent electrodes 2 more highly than both refractive index, a high refractive-index layer and the layer which has periodic refractive-index distribution may be formed separately. Also by this configuration, the optical waveguide from which an effctive index changes periodically can be formed.

[0045] Moreover, in this example, although the high refractive-index layer 6 with a refractive index higher than a transparent electrode 2 is used in order to form optical waveguide, the optical waveguide which does not necessarily need to form a refractive-index layer higher than a transparent electrode 2, for example, will make a transparent electrode 2 a subject if the refractive index of a transparent electrode 2 itself is higher than the organic luminous layer 4 is formed. Therefore, if the layer which has periodic refractive-index distribution near the organic luminous layer 4 or the transparent electrode 2 is formed, the optical waveguide which has periodic structure in an effctive index substantially will be formed, and a waveguide mold resonator will be formed.

[0046] Moreover, in this example, although the periodic high refractive-index layer 6 which has periodic high refractive-index distribution is installed between the organic luminous layer 4 and the transparent electrode 2, it does not necessarily need to be installed between the organic luminous layer 4 and a transparent electrode 2, for example, may be formed between a transparent electrode 2 and a glass substrate 1 or between the organic luminous layer 4 and the metal-electrode layer 5.

[0047] (Gestalt 2 of operation) The more concrete component configuration of this invention is explained below. It explains referring to drawing 2 about the light emitting device concerning the 2nd operation gestalt.

[0048] In drawing 2 , 21 is a glass substrate. The transparent dielectric layer 267 which arranged periodically two kinds of dielectrics with a high refractive index, for example, titanium oxide, and zinc sulfide by turns is formed in the front face of a glass substrate 21, and the anode plate as a transparent electrode layer 22 which becomes with indium oxide tin further is formed on it. In the front face of the transparent electrode layer 22, it is triphenyl diamine (TPD [N and N '-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed) as an electron hole transporting bed 23. Sequential formation of the cathode by the organic luminous layer 24 and metal electrode 25 of the electronic transportability by organic semiconductor like an aluminum quinolinol complex (Alq [tris (8-hydroxyquinoline) aluminium]) is carried out on it. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 24 from an anode plate 22 and cathode 25, respectively.

[0049] Since the refractive index of the dielectric layer 267 arranged near the organic luminous layer 24 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the dielectric layer 267 pinched by the two layers or a medium 24 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 21, and the generated light is spread in the direction parallel to a glass substrate 21 as a waveguide light. Since periodic refractive-index distribution is formed in the dielectric layer 267, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is

formed in parallel with a glass substrate 21 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 24 emits light strongly, and is emitted outside.

[0050] (Gestalt 3 of operation) Although it was formed so that a dielectric layer 267 might form periodic refractive-index distribution in the gestalt 2 of operation, the transparent electrode itself may have periodic refractive-index distribution. It explains referring to drawing 3 as a gestalt 3 of operation of a concrete component configuration.

[0051] In drawing 3 , 31 is a glass substrate and the anode plate [consist / of the transparent electrode 3267 which becomes with the indium oxide tin from which the presentation ratio is changing periodically] is formed in the front face. In the front face, it is the triphenyl diamine (TPD [N and N '-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed) as an electron hole transporting bed 33. Furthermore, sequential formation of the cathode by the organic luminous layer 34 and metal electrode 35 of electronic transportability which become with the aluminum quinolinol complex (Alq [tris(8-hydroxyquinoline) aluminium]) which is an organic semiconductor is carried out. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 34 from an anode plate 3267 and cathode 35, respectively.

[0052] Since the refractive index of the transparent electrode 3267 arranged near the organic luminous layer 34 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode 3267 inserted into the two layers or a medium 34 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 31, and the generated light is spread in the direction parallel to a glass substrate 31 as a waveguide light. Since periodic refractive-index distribution is formed in the transparent electrode 3267, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 31 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 24 emits light strongly, and is emitted outside.

[0053] (Gestalt 4 of operation) Below, it explains, referring to drawing 4 about the light emitting device concerning the gestalt 4 of operation of this invention.

[0054] In drawing 4 , 41 is a glass substrate and the transparent electrode 4267 which becomes with indium oxide tin is formed in the front face as an anode plate. The transparent electrode 4267 is changing thickness periodically and periodic concavo-convex structure is formed in the front face. In the front face of a transparent electrode 4267, it is the triphenyl diamine (TPD [N and N '-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed) as an electron hole transporting bed 43. Sequential formation of the organic luminous layer 44 of the electronic transportability which becomes with the aluminum quinolinol complex (Alq [tris(8-hydroxyquinoline) aluminium]) which is an organic semiconductor on it, and the cathode by the metal electrode 45 is carried out further. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 44 from an anode plate 4267 and cathode 45, respectively.

[0055] Since the refractive index of the transparent electrode 4267 arranged near the organic luminous layer 44 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode 4267 inserted into the two layers or a medium 44 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 41, and the generated light is spread in the direction parallel to a glass substrate 41 as a waveguide light. Since periodic refractive-index distribution is formed of the periodic concavo-convex structure of a transparent electrode 4267, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 41 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 44 emits light strongly, and is emitted outside.

[0056] (Gestalt 5 of operation) It explains, referring to drawing 5 about the light emitting device concerning the gestalt 5 of operation of this invention.

[0057] In drawing 5 , 51 is a glass substrate. The dielectric layer 56 which has a high refractive index is formed on a glass substrate 51, the transparent electrode 52 which becomes with indium oxide tin is further formed in the front face, and the hole injection layer 57 which has periodic refractive-index structure is formed in the front face of a transparent electrode 52. On a hole injection layer 57, it is the triphenyl diamine (TPD [N and N'-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed.) as an electron hole transporting bed 53. Sequential formation of the cathode by the organic luminous layer 54 and metal electrode 55 of electronic transportability which become with the aluminum quinolinol complex (Alq [tris (8-hydroxyquinoline) aluminium]) which is an organic semiconductor further on it is carried out. In the organic luminous layer 54, luminescence arises by pouring in an electron hole and an electron from an anode plate 52 and cathode 55, respectively.

[0058] Since the refractive index of the dielectric layer 56 arranged near the organic luminous layer 54 by the principle

same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode layer 52 pinched by the two layers or a medium 54 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 51, and the generated light is spread in the direction parallel to a substrate as a waveguide light. Since periodic refractive-index distribution is formed in the hole injection layer 57, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 51 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 54 emits light strongly, and is emitted outside.

[0059] (Gestalt 6 of operation) It explains, referring to drawing 6 about the light emitting device concerning the gestalt 6 of operation of this invention.

[0060] In drawing 6 , 61 is a glass substrate. The transparent electrode 626 of the high refractive index which becomes with indium oxide tin is formed on a glass substrate 61, and the hole injection layer 67 which has periodic refractive-index structure is formed in the front face of a transparent electrode 626. It is triphenyl diamine (TPD [N and N '-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed.) as an electron hole transporting bed 63 on a hole injection layer 67. Sequential formation of the cathode by the organic luminous layer 54 and metal electrode 65 of electronic transportability which become with the aluminum quinolinol complex (Alq [tris (8-hydroxyquinoline) aluminium]) which is moreover an organic semiconductor is carried out. In the organic luminous layer 64, luminescence arises by pouring in an electron hole and an electron from an anode plate 626 and cathode 65, respectively.

[0061] Since the refractive index of the transparent electrode 626 arranged near the organic luminous layer 64 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode 626 inserted into the two layers or a medium 64 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 61, and the generated light is spread in the direction parallel to a glass substrate 61 as a waveguide light. Since periodic refractive-index distribution is formed in the hole injection layer 67, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 61 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 64 emits light strongly, and is emitted outside.

[0062] (Gestalt 7 of operation) It explains, referring to drawing 7 about the light emitting device concerning the gestalt 7 of operation of this invention.

[0063] In drawing 7 , 71 is a glass substrate. the dielectric layer 77 which has the periodic refractive-index structure which repeated periodically by turns two dielectrics with which refractive indexes differ mutually on a glass substrate 71, for example, silicon oxide, and titanium oxide, and high -- the refractive index transparent electrode (transparent electrode which becomes with indium oxide tin) 726 is formed. It is triphenyl diamine (TPD [N and N '-bis-(3-methylphenyl) (1 and 1'-biphenyl)-4 and 4'-diamine] is formed.) as an electron hole transporting bed 73 on a transparent electrode 726. Sequential formation of the cathode by the organic luminous layer 74 of the electronic transportability which becomes on it with an organic-semiconductor aluminum quinolinol complex (Alq [tris (8-hydroxyquino) aluminium]), and the metal electrode 75 is carried out. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 74 from an anode plate 72 and cathode 75, respectively.

[0064] Since the refractive index of the transparent electrode 726 arranged near the organic luminous layer 74 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode layer 726 pinched by the two layers or a medium 74 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 71, and the generated light is spread in the direction parallel to a glass substrate 71 as a waveguide light. Since periodic refractive-index distribution is formed in the dielectric layer 77, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 71 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 74 emits light strongly, and is emitted outside.

[0065] (Gestalt 8 of operation) It explains, referring to drawing 8 about the light emitting device concerning the gestalt 8 of operation of this invention.

[0066] In drawing 8 , 81 is a glass substrate. A dielectric 87 is formed on a glass substrate 81, and concavo-convex structure is given to the front face. The transparent electrode 826 which covers this concavo-convex structure and has a high refractive index is covered. On a transparent electrode 826, it is triphenyl diamine (TPD [N and N '-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed, and sequential formation of the cathode by the organic luminous layer 84 and metal electrode 85 of electronic transportability which come on it further with an organic-semiconductor aluminum quinolinol complex (Alq [tris (8-hydroxyquinoline) aluminium]) is carried out.) as an

electron hole transporting bed 83. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 84 from an anode plate 826 and cathode 85, respectively.

[0067] Since the refractive index of the transparent electrode 826 arranged near the organic luminous layer 84 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode layer 826 pinched by the two layers or a medium 84 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 81, and the generated light is spread in the direction parallel to a glass substrate 81 as a waveguide light. Since periodic refractive-index distribution is formed in the dielectric layer 87, distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 81 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 84 emits light strongly, and is emitted outside.

[0068] (Gestalt 9 of operation) It explains, referring to drawing 9 about the light emitting device concerning the gestalt 9 of operation of this invention.

[0069] In drawing 9 , 91 is a glass substrate. A dielectric 97 is formed in the shape of a stripe on a glass substrate 91, and dielectric 97' which has a refractive index which covers a it top and is different in a dielectric 97 is covered. The transparent electrode 926 of a high refractive index, for example, the transparent electrode which becomes with indium oxide tin, is formed on dielectric layer 97'. Furthermore, it is triphenyl diamine (TPD [N and N '-bis (3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed further) as an electron hole transporting bed 93 on a transparent electrode 926. Sequential formation of the cathode by the organic luminous layer 94 of the electronic transportability which becomes with an organic-semiconductor aluminum quinolinol complex (Alq [tris (8-hydroxyquinoline) aluminium]), and the metal electrode 95 is carried out. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 94 from an anode plate 92 and cathode 95, respectively. Since the refractive index of the transparent electrode 926 arranged near the organic luminous layer 94 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode layer 926 pinched by the two layers or a medium 94 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 91, and the generated light is spread in the direction parallel to a glass substrate 91 as a waveguide light. Since periodic refractive-index distribution is formed of a dielectric layer 97 and 97', distribution periodic to the effctive index is formed in the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 91 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 94 emits light strongly, and is emitted outside.

[0070] (Gestalt 10 of operation) It explains, referring to drawing 10 about the light emitting device concerning the gestalt 10 of operation of this invention.

[0071] In drawing 10 , 101 is a glass substrate. The stripe-like dielectrics 107 and 117 with which periodic width of face differs mutually and whose number is two are formed on a glass substrate 101, and the dielectric layer 127 which has a refractive index which covers a it top and is different in these dielectric stripes 107 and 117 is covered. The transparent electrode 1026 of a high refractive index, for example, the transparent electrode which becomes with indium oxide tin, is formed on the dielectric layer 127. Furthermore, it is triphenyl diamine (TPD [N and N '-bis(3-methylphenyl)-(1 and 1'-biphenyl)-4 and 4'-diamine] is formed, and sequential formation of the cathode by the organic luminous layer 104 of the electronic transportability which becomes with an organic-semiconductor aluminum quinolinol complex (Alq [tris (8-hydroxyquinoline) aluminium]), and the metal electrode 105 is carried out further.) as an electron hole transporting bed 103 on a transparent electrode 1026. Luminescence arises by pouring an electron hole and an electron into the organic luminous layer 104 from an anode plate 102 and cathode 105, respectively.

[0072] Since the refractive index of the transparent electrode 1026 arranged near the organic luminous layer 104 by the principle same here as the gestalt 1 of operation explained is high, the generated light is shut up near the transparent electrode layer 1026 pinched by the two layers or a medium 104 with a low refractive index, i.e., an organic luminous layer, and the glass substrate 101, and the generated light is spread in the direction parallel to a glass substrate 101 as a waveguide light. Since two different periodic refractive-index distribution is formed of dielectric layers 107, 117, and 127, two different periodic distribution is formed in the effctive index at the waveguide of the light to spread. Therefore, as the gestalt 1 of operation explained, an optical resonator is formed in parallel with a glass substrate 101 of distribution of the effctive index formed in optical waveguide, and only the light of the specific wavelength determined with this resonator among the light emitted by the organic luminous layer 104 emits light strongly, and is emitted outside. Since the optical resonator has two different periodic refractive-index distribution at this time, the light emitted outside becomes mutually different wavelength 1 and wavelength 2, and can obtain the luminescence light of two colors.

[0073] If periodic refractive-index distribution which is further different in the periodic structure of a dielectric layer is

formed, luminescence of three colors is also possible, and if these three colors are made to correspond to red, blue, and green, luminescence in three primary colors is attained and can realize a color display.
[0074]
[Effect of the Invention] As explained to the detail above, the organic thin film layer and cathode where this invention contains an anode plate and a luminous layer at least on a substrate are formed. In the organic light emitting device which luminescence produces in a luminous layer by injecting an electron hole and an electron into an organic thin film layer from an anode plate and cathode, respectively It is what offers the organic light emitting device which a refractive index can form the optical waveguide which has periodic structure in the direction parallel to a substrate front face, and can take out the light of the luminescence wavelength corresponding to this periodic structure. Luminescence which moreover excelled [wavelength / desired] in monochromaticity can be carried out, and the color display of high definition and high-reliability can be obtained.

[Translation done.]

* NOTICES *

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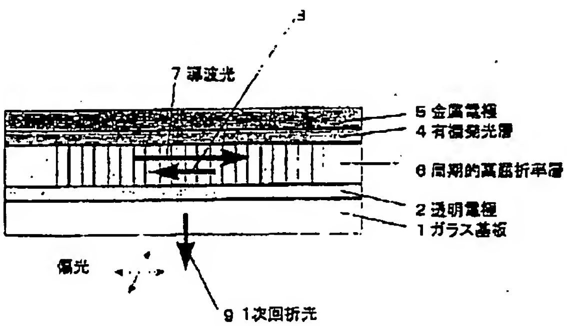
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]
(A)



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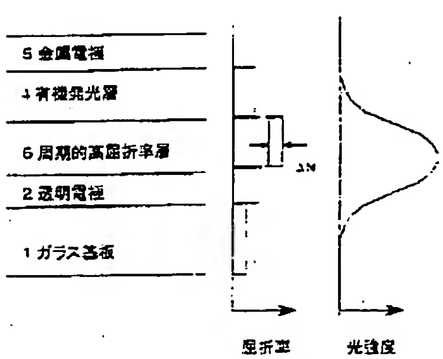
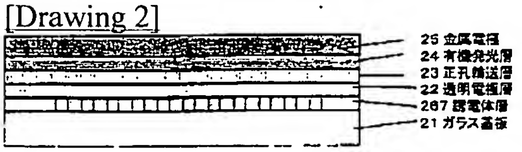
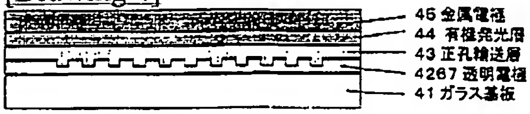


[Drawing 2]

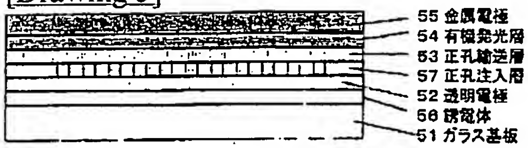


[Drawing 3]

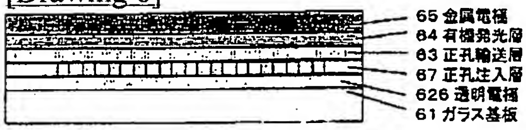
[Drawing 4]



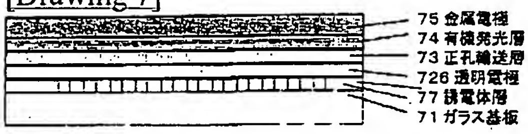
[Drawing 5]



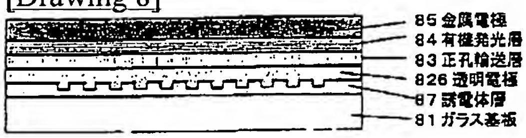
[Drawing 6]



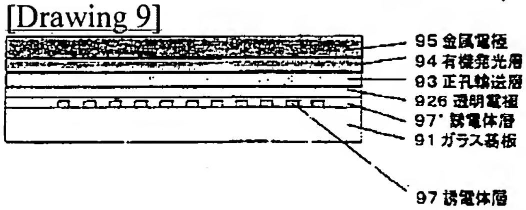
[Drawing 7]



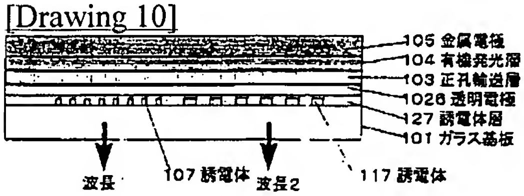
[Drawing 8]



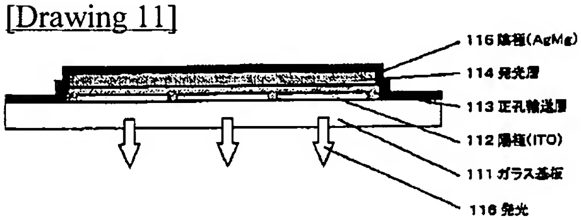
[Drawing 9]



[Drawing 10]



[Drawing 11]



[Translation done.]